REMARKS

In the Final Office Action, the Examiner rejected all of the pending claims under 35 U.S.C. § 103. In response, Applicants filed a Notice of Appeal. In preparing their appeal brief, Applicants became aware of further evidence of patentability, and to enter this evidence, Applicants have filed this response together with a Request for Continued Examination.

35 U.S.C. § 103 Rejection of Claims 1-23

Claims 1-23 were rejected on pages 2-9 of the Final Office Action as being obvious in view of the combination of Chinese Patent No. 1281906 to Weiji (hereinafter "Weiji"), U.S. Patent No. 4,605,449 to Schummer et al. (hereinafter "Schummer") and U.S. Patent No. 4,138,278 to Nakasugi et al. (hereinafter "Nakasugi"). The Examiner alleges that it would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teaching of Schummer and Nakasugi of a lesser carbon percent than 0.25 to 0.33% as taught by Weiji with the additional teaching from Nakasugi of a chromium content of no more than 0.6% to arrive at Applicants claimed steel. On pages 6-9 of the Final Office Action, the Examiner further explains the combination of references by asserting that "both Weiji and Nakasugi teach steel with excellent toughness at low temperature and the application is not particularly for use in sea water but to only securing or fastening loads, it would have been obvious for one of ordinary skill in the art at the time of the invention to learn from both teaching and experimentation and optimization would certainly combine and substitutes the teaching of lower content to improve the welding performance and mechanical strength at low temperature." (See pages 7 and 8.) The Examiner further states that "Weiji teaches a lower range for chromium of 0.9% and Nakasugi teaches that at higher than 0.6% of chromium, it would affect the HAZ of the weld and therefore it would be obvious for anyone who wants to improve further the toughness of the chain, would find way to improve the mechanical strength of the chain by improving performance of the weld which is the weakest link." (See page 8 of the Final Office Action).

From the above passages, it appears that the Examiner is arguing that as both Weiji and Nakasugi are directed to high strength steels with excellent toughness at low temperature, then it would be obvious to substitute or optimize any one or more of Weiji's alloying elements with any one or more teaching in Nakasugi or Schummer as the combination would produce a

predictable result. For example, the Examiner has set forth a rationale to modify the chromium content of Weiji in accordance to the teaching of Nakasugi as corrosion from salt is not a priority of Applicants' or Nakasugi's steel. Thus, according to the Examiner, it would have been obvious to one of ordinary skill in the art that an improvement to mechanical properties could be realized by optimizing the chromium content in accordance with the teaching of Nakasugi. Applicants respectfully disagree for numerous reasons.

First, Applicants respectfully submit that alloying concentrations and their effects on the final product are dependent not merely on a single alloy element content, but also on their relationship to the other alloying elements included (or as the case may be, alloying elements not included). Alloying of steel is not a predictable science, where the mere substitution of one compositional range for another will produce a steel having a known desired property. Rather, the complex interactions between the different alloying elements leads to numerous possible steel compositions, each having their own properties. In addition, the effect each alloying element has is not additive. As a result, Applicants respectfully submit that the field of the invention is not a predictive science in which modifications to alloying content can be made in a modular way without consideration to all of the other alloying elements.

In support of Applicants' assertion, Applicants enclose pages 182 and 191 from Barge/Schulze "Werkstoffkunde" ("Materials Science") and an English translation of these passages, which state the following:

> In no other material can the properties be changed to such a great extent by alloying as in steel. The alloyed steel, apart from iron and carbon, generally contains a plurality of alloying elements. The property changes which have occurred can therefore only be given in a very general form. Precise predictions are also generally not possible because the effects of the alloying elements is not additive. – From p. 182

> In no other material can the properties be changed to such a great extent by alloying as in steel. The alloyed steel, apart from iron and carbon, generally contains a plurality of alloying elements.

> Because of the complex interactions between the alloying elements and their non-additive effect, the property changes which have occurred can therefore only be given in very general form. From p. 191

As the Barge/Schulze reference supports Applicants assertion that the field of the invention is not a predictive science, Applicants respectfully submit that it would be improper hindsight to select or modify alloying elements in a modular way. That is, it would be improper hindsight to modify one of a series of 10 or more alloying elements of steel disclosed in one reference in accordance with just a portion of a teaching of a different reference without regard to the full disclosure or teaching of each reference. That is, the teachings of each reference must be taken as a whole; the Examiner may not merely pick and choose between different aspects or portions of the teaching. See, for example MPEP 2141.02VI.

In the combination proposed by the Examiner, there are multiple reasons why the teachings of Nakasugi and Weiji would not lead one of ordinary skill in the art to Applicants' claimed invention.

First, Nakasugi ties content amounts of not only chromium, but also nickel, and copper to corrosion resistance. (See, for example, column 8, lines 12-34 Nakasugi). Further Nakasugi ties chromium, nickel and copper content with a low carbon content (i.e., lower than 0.13%) together with **NO** niobium. (See, for example, column 8, lines 4-11). Therefore, taking the teaching of Nakasugi as a whole, not only would one of ordinary skill in the art have to first determine that only the chromium content (and not the nickel and copper contents) be optimized[1], but also and more importantly, one of ordinary skill in the art would have to ignore the multiple passages in Nakasugi requiring the elimination of niobium and the tie of the no niobium content to the chromium content.[2] (See, for example, column 4, lines 4-7 and column 8, column 4-11). As a

[1] The Examiner alleges that Weiji teaches Applicants claimed steel composition, except for the carbon and chromium contents. The Examiner relies on Nakasugi for teaching the chromium content in a steel with a reduced carbon content as compared to Weiji.

[2] Applicants claimed alloy requires the presence of niobium. Weiji's steel also allows for niobium, whereas Nakasugi forbids the inclusion of niobium.

result, Applicants respectfully submit, that the entirety of the teaching of Nakasugi, if applied to Weiji, would require not only a reduction in carbon content, and chromium content as the Examiner has suggested, but also an elimination of niobium, which would prevent the combination from teaching all elements of Applicants' claim 1 (as Applicants' claim 1 requires the niobium).

Applicants also respectfully submit that the teaching of Weiji taken as a whole, also does not support the modification as proposed by the Examiner. Applicants enclose a machine translation of Weiji as provided by the Chinese Patent Office in support of their position. First, Applicants note that the disclosure of Weiji describes that a chromium content of up to 1.4% can be utilized without having an effect on the welding seam properties. (See, for example, page 4 of the enclosed machine translation.) Thus, while the Examiner has relied on Nakasugi's disclosure of up to 0.6% chromium as the teaching which provides the motivation to reduce or optimize chromium due to its effects on HAZ properties, Weiji provides disclosure of a higher content that can be included without having an effect on welding properties. As a result, Applicants submit that the disclosure of Weiji would have discouraged or not have motivated one of ordinary skill in the art to lower the chromium content as a means to effect the welding properties. Applicants also note that the disclosure provided in each of these two references regarding steels with differing alloy concentrations further supports Applicants' assertion that properties are not additive and that the field of the invention is not a predictive science. That is, the alloy elements and compositions of Weiji and Nakasugi differ and so do their teachings on the amount of chromium which can be included without effect on welding properties, thereby showing that alloy concentrations can not be selected in a modular way with no regard to the other alloying constituents.

In addition, Weiji describes on pages 2 and 3 of the machine translation the importance of carbon content on the high strength properties of steel. Weiji links the carbon content to the chromium content and provides a relationship between carbon and chromium through a carbon equivalent (Ce) content, i.e., $Ce = C\% + 1/3\ Cr\% + 2/3\ Mo\% \geq 1.4$. One of ordinary skill in the art starting with the teaching of Weiji learns that any lowering of the chromium content would result in raising the carbon content to satisfy the carbon equivalent content relationship provided

by Weiji to provide excellent high strength properties. Applicants' note that Weiji discloses an ultimate tensile strength of 900-1070 MPa (see page 6 of the machine translation), whereas Nakasugi discloses an ultimate tensile strength of less than 670 MPa (see Tables in columns 11, 12, 13, and 14, Tensile Strength, of Nakasugi). As a result, if one of ordinary skill in the art selected the disclosure of Weiji as the starting steel material for its high strength properties, it would not be obvious to ignore Weiji's teaching of the importance of carbon content on high strength properties and lower both of Weiji's chromium content and carbon content well outside of Weiji's disclosed carbon equivalent content so that high strength properties would be lost.

Applicants further support their assertion that the field of the invention is not a predictive science, by comparing properties of ultimate tensile strength between the disclosures of Weiji, Nakasugi and Applicants' claimed invention. As discussed above Weiji provides for an ultimate tensile strength of up to1070 MPa. Weiji links high strength properties to its carbon equivalent content, which relies on including a carbon content and a chromium content which lie outside of the ranges claimed by Applicants. Nakasugi discloses an ultimate tensile strength of less than 670 MPa. Nakasugi provides a steel content that has an alloying content that differs from Applicants' claims in many different respects[3], but includes a content of carbon and chromium, which is lower than that allowed by Weiji. Schummer, the third reference used by the Examiner as a basis for an obviousness rejection, has a carbon content that overlaps in part with Applicants' claimed invention, but does not provide for any chromium[4]. Schummer has an ultimate tensile strength of 980 MPa. The above ultimate tensile strength values of high strength steels which have varying contents of carbon and chromium illustrate that there is no additive or predictive nature to be relied upon for modifying a steel composition.

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[3] Applicants note that the Examiner's chart on pages 2 and 3 of the Final Office Action appears to contain errors with respect to the alloying concentrations of Nakasugi. This error was pointed out in Applicants' previous response on page 3, footnote 6.

[4] Applicants note that Shummer doesn't cure or correct the deficiencies of the improper combination of Weiji and Nakasugi as Shummer is silent with respect to chromium inclusion and therefore would not provide any guidance or motivation to one of ordinary skill in the art on a modification of chromium content of Weiji to Applicants' claimed range. In addition, on page 9 of the Final Office Action, the Examiner asserts that one would learn from Schummer that a steel with no niobium can be used to provide low temperature toughness as the key elements of toughness are not niobium, but Cr, Ni and N. Applicants respectfully submit that Schummer's alloy can include niobium but there is no disclosure of chromium. As a result, Schummer can not provide any teaching or suggestion with respect to the effects of adding, removing, or modifying chromium content.

Moreover, as provided on pages 7 and 9 of Applicants' originally-filed English Translation of the Specification, the ultimate tensile strength of a steel having alloy within the claimed range is at least 1200 MPa and in some embodiments more than 1650 MPa, which is well above each of the three cited references. Applicants respectfully submit that the vast difference in ultimate tensile strength between Applicants' claimed steel composition and each of Weiji, Nakasugi, and Schummer, is evidence of an unexpected result, which further supports Applicants' position that the claims are not obvious in view of the cited references and are patentable.

In view of the unpredictable nature of the field of the invention, the incompatible teachings of the cited references, and the unexpected results provided by the invention with respect to strength, Applicants request reconsideration and the withdrawal of all pending rejections to the claims.

CONCLUSION

Applicants respectfully submit that the claims are in condition for allowance and request favorable action. The Examiner is invited to contact Applicants' attorney at the number below if in the Examiner's view it would expedite the examination of the application.

The Commissioner is hereby authorized to charge any fee occasioned by the entry of this paper to Attorney's Deposit Account No. 50-3081

Respectfully submitted,

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